



GPM Science Status



Gail Skofronick Jackson

GPM Project Scientist

NASA Goddard Space Flight Center

PMM Science Team Meeting

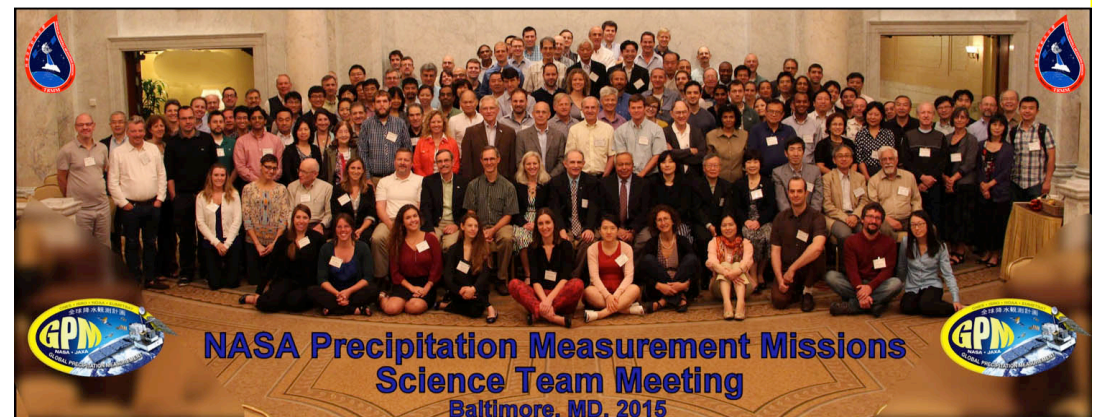
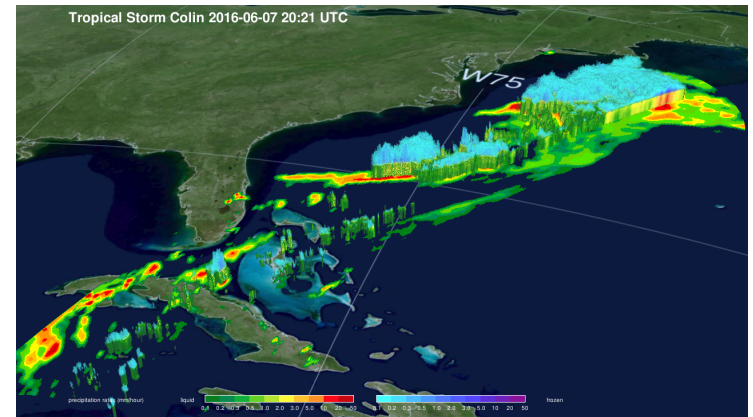
October 24-27, 2016

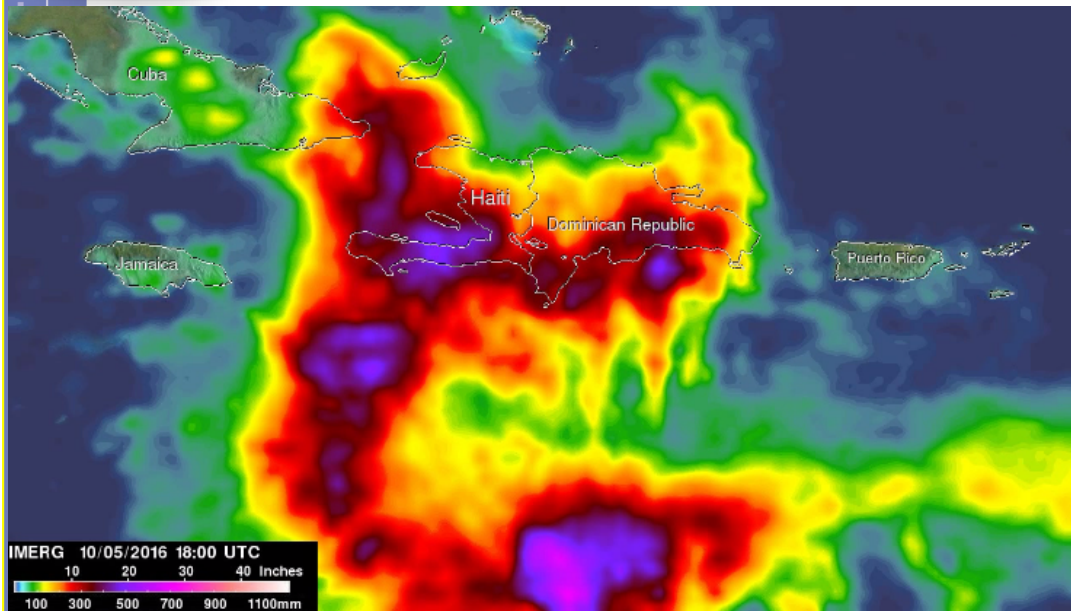
www.nasa.gov/gpm

Twitter: NASA_Rain

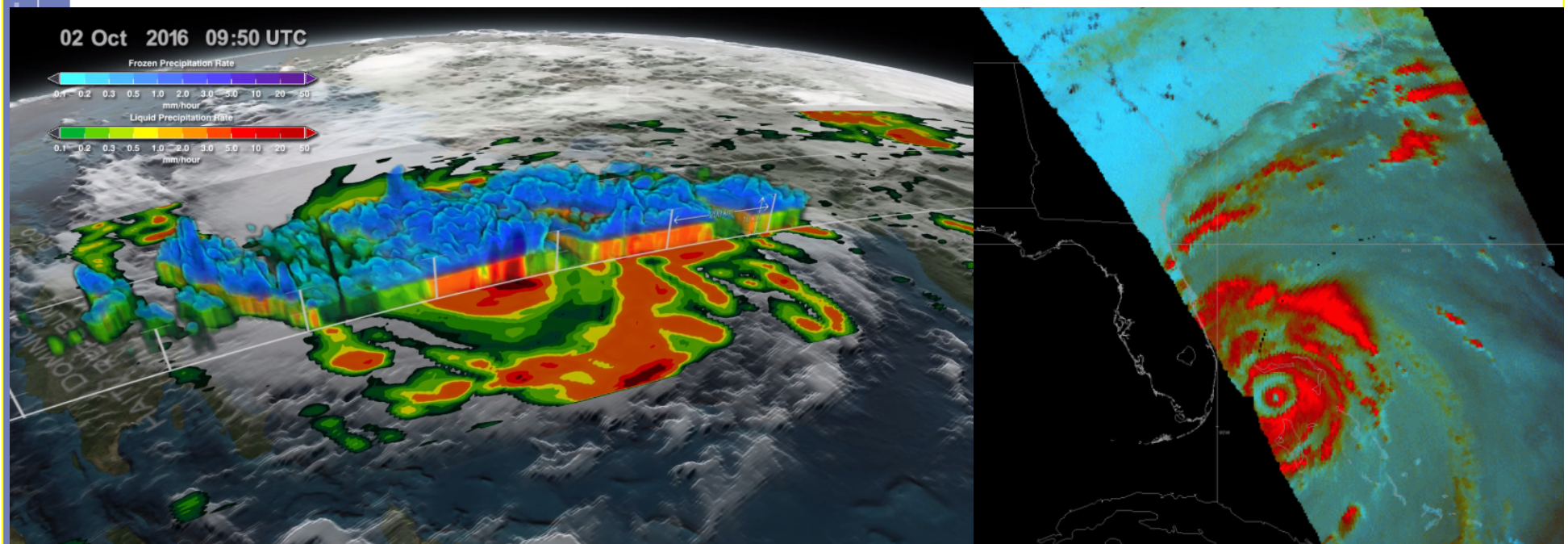
Facebook: NASA.Rain

- Highlights of GPM measurements
- Status of the GPM Core Observatory spacecraft, its data and requirements
- Science team and activities
- Upcoming Reviews
- Awards and honors





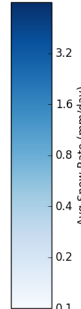
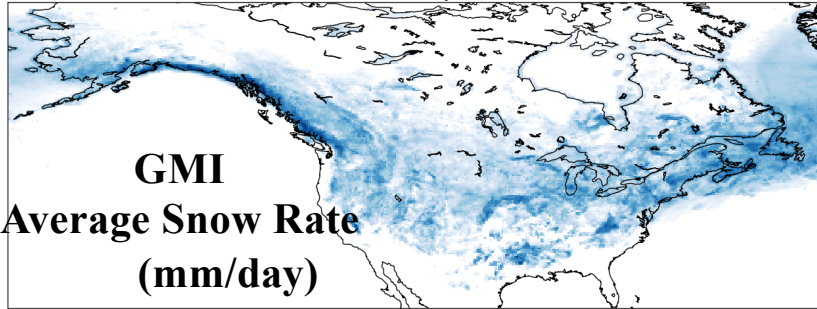
- GPM observed intense rainfall accumulation (left) as Matthew (2016) intensified and battered Hispaniola and Cuba
- On Oct. 2nd (bottom left) GPM Core Observatory viewed a newly intensified Cat 4 storm south of Haiti, showing strong convection and heavy rainfall in the eye wall and rain bands
- GPM's Microwave Imager (bottom right) observed the storm going through eye wall replacement before impacting Florida as a Cat. 3. (Provided by MSFC SPoRT)
- This data was provided to FEMA and NWS Offices for situational awareness



GMI

GMI USA DJF

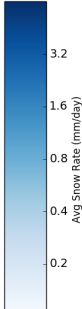
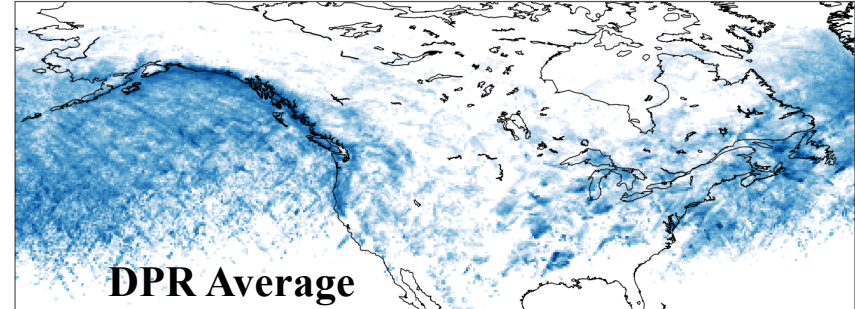
GMI
Average Snow Rate
(mm/day)



DPR

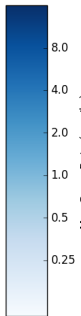
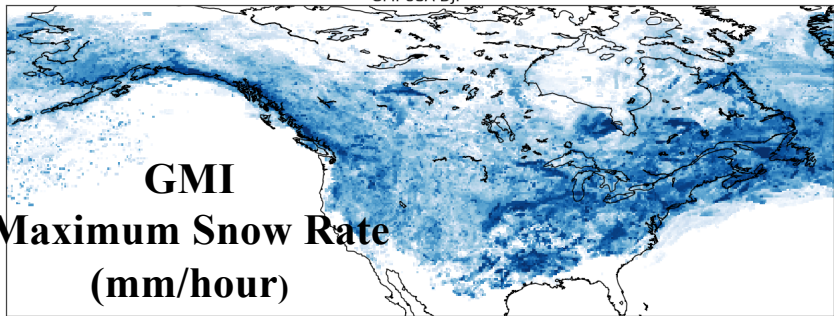
USA DJF NS

DPR Average



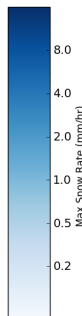
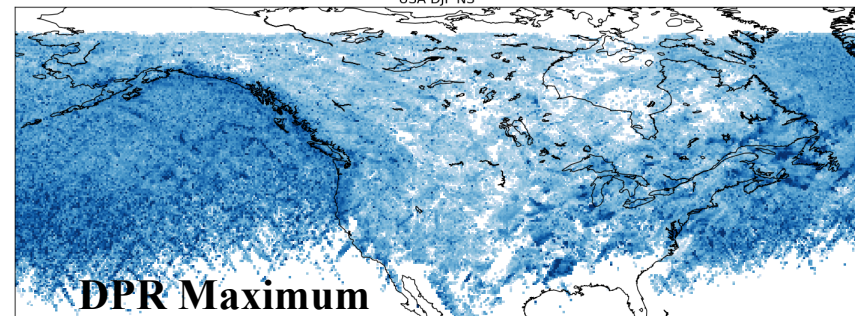
GMI USA DJF

GMI
Maximum Snow Rate
(mm/hour)



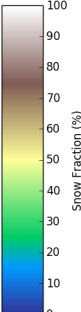
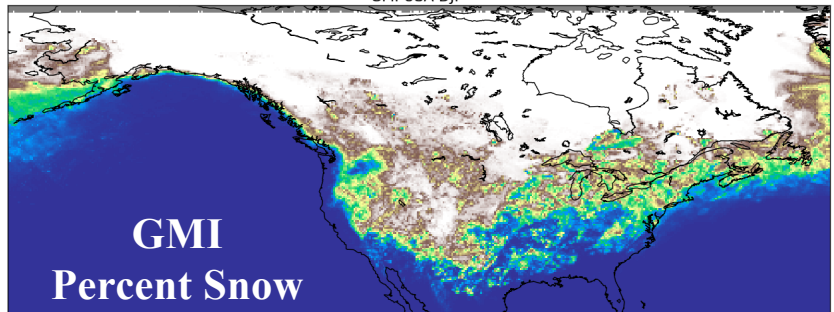
USA DJF NS

DPR Maximum



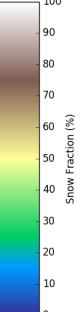
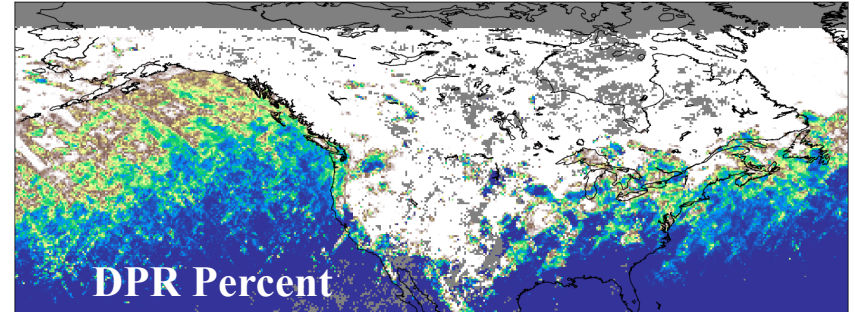
GMI USA DJF

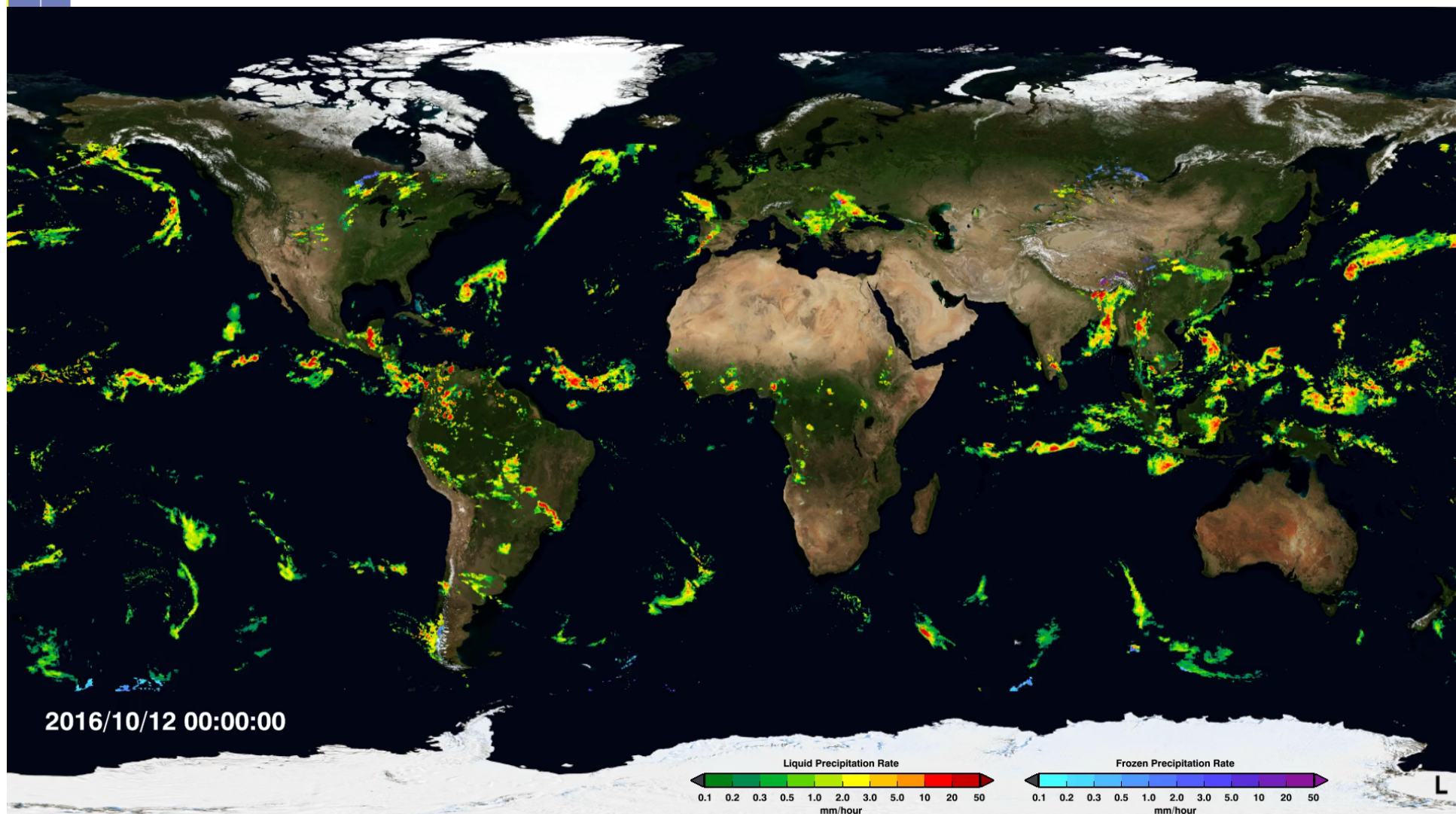
GMI
Percent Snow



USA DJF NS

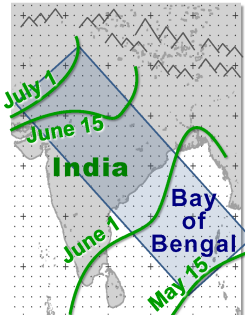
DPR Percent



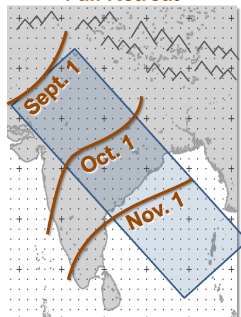


30 minute by 0.1deg by 0.1deg; available ~ 4-6 hours after obs.

The Monsoon's
Climatological
Summer Advance



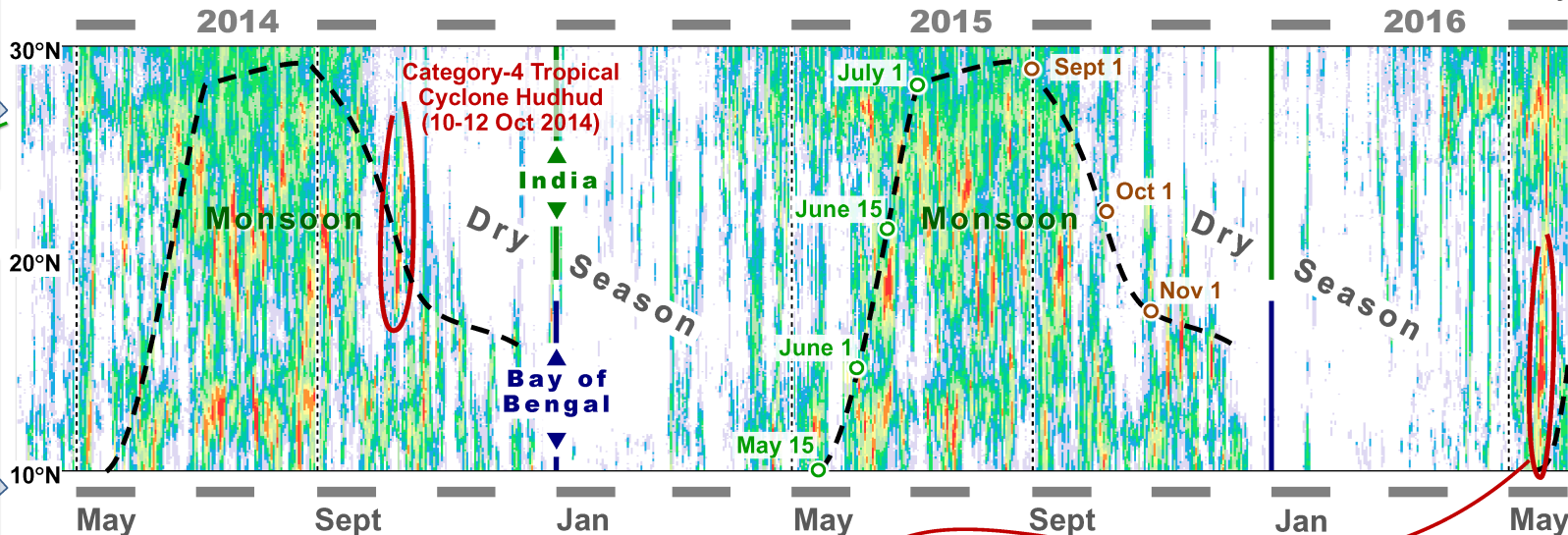
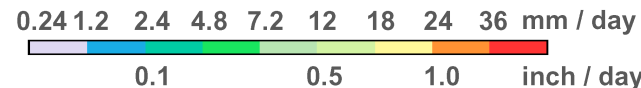
The Monsoon's
Climatological
Fall Retreat



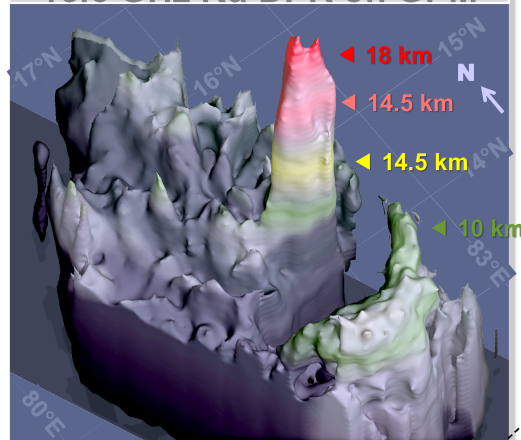
India's Monsoon & Tropical Storms

Tracking the monsoon's annual,
north-south march across India

Average daily precipitation from the
30-minute 0.1° IMERG data product

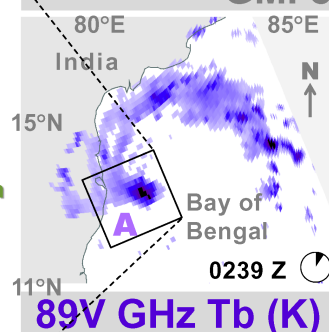


13.6 GHz Ku DPR on GPM



Hot Tower in **Tropical Storm Roamu** passing India's East Coast (18 May 2016)

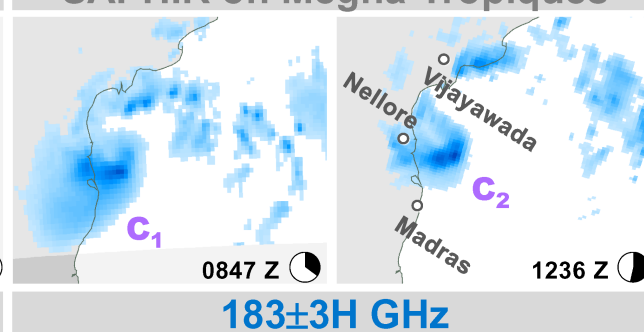
GMI on GPM



89V GHz Tb (K)

183±3V GHz Tb

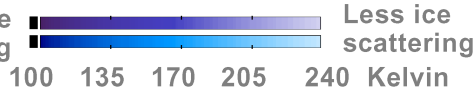
SAPHIR on Megha-Tropiques



183±3H GHz

Passive microwave
brightness temperature

More ice
scattering



Less ice
scattering

Spacecraft Status:

C&DH:	GREEN	GN&C:	GREEN
Deployables:	GREEN	Propulsion:	GREEN
EPS:	GREEN	RF/Comm:	GREEN
FSW:	GREEN	Thermal:	GREEN

Instrument Status:

DPR - KaPR:	GREEN	DPR - KuPR:	GREEN
GMI:	GREEN (well calibrated & stable)		

Data Capture Statistics:

2015 Capture %:	100.000 %
Mission Capture %:	100.000 %
2015 Data Volume:	1,149.55 GB

Data Products:

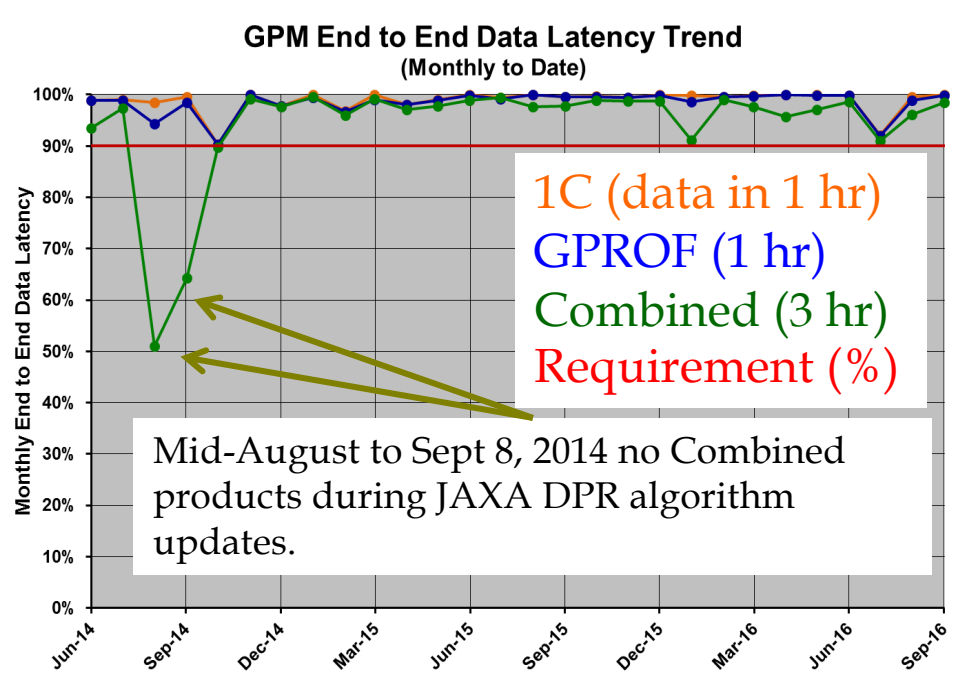
GPM Version 04 reprocessing March-June 2016
- except IMERG
GPM Version 05 expected Spring 2017
TRMM Ver. 8 expected in late 2017/early 2018

Average monthly downloads ~ 61TB
More than 6.5 million files/month
Downloads from users and agencies worldwide

Want GPM/TRMM data?

<http://pps.gsfc.nasa.gov>
<http://gpm.nasa.gov>

Data available for DPR, GMI, Combined, IMERG
and constellation partners (instrument,
instantaneous & gridded), Visualization tools



Fuel Predictions (w/controlled re-entry)

Prediction	Plus/Early	Mean/Nominal	Minus/Late
June-2015	06/2029	11/2039	06/2043
Nov-2015	03/2027	04/2035	08/2039
May 2016	03/2032 (18 years)	04/2037 (23 years)	08/2047 (33 years)

Fuel is unlikely to be the limiting
factor for GPM

Science Requirements

- Measurements of the same geophysical scenes using both active and passive technique from 65N to 65S latitude with mean sampling time of 24 hours
- DPR, Ku/Ka bands
 - Quantify rain rates between 0.22 {0.3} and 110 mm/hr
 - Detection of snowfall at effective resolution of 5 km
- GMI, multi-channel wide-band
 - Quantify rain rates between 0.2 {0.3} and 60 mm/hr
 - Detection of snowfall at effective resolution of 15 km
- Estimate precipitation particle size distribution
- Rain rate biases at 50 km resolution <50% at 1 mm/hr; <25% at 10 mm/hr {within the tropics}
- {Outside the tropics: Rain rate biases at 50 km resolution <100% at 1 mm/hr; <50% at 10 mm/hr}
- Rain rate random error at 50 km resolution <50% at 1 mm/hr; <25% at 10 mm/hr {within the tropics}
- {Outside the tropics: Rain rate random error at 50 km resolution <100% at 1 mm/hr; <50% at 10 mm/hr}
- Standard data products (level 1, 2, 3), metadata and documentation available to all users
- Combined radar/radiometer swath products available within 3 hours of observation time, 90% of the time
- Radiometer precipitation products available within 1 hour of observation time, 90% of the time

Core Observatory Space Segment

- Design life of 3 years, with propellant sized for 5 years
- Orbit maintained to within +/- 1 km of operational orbital attitude
- LRD February 2014 [internal commitment]
- Meet NPR 8715.6A and NSS 1740.14 requirements for limiting orbital debris

Ground Segment

- Core observatory monitoring and control (8x5 staffing, with automation at other times, after PLAR)
- Precipitation Processing System operations
- Ground validation

Core Observatory Launch Segment

- JAXA-provided H-IIA ELV
- Launch from Tanegashima, Japan
- 407 km, 65 degree inclination orbit

Mission Success

- Meet the Threshold Performance Requirements, excepting the data latency requirements, for a minimum of three years.

Data latency requirements eliminated pre-launch

Baseline Performance
Threshold Performance

Mission Success Criteria simplified and updated in May 2012

Mission Operations (MO) – Spacecraft Operations
(Jamie Pawloski)

Precipitation Processing System (PPS)
– raw instrument data to precipitation products
(Erich Stocker)

GPM Program Scientist
(Ramesh Kakar)

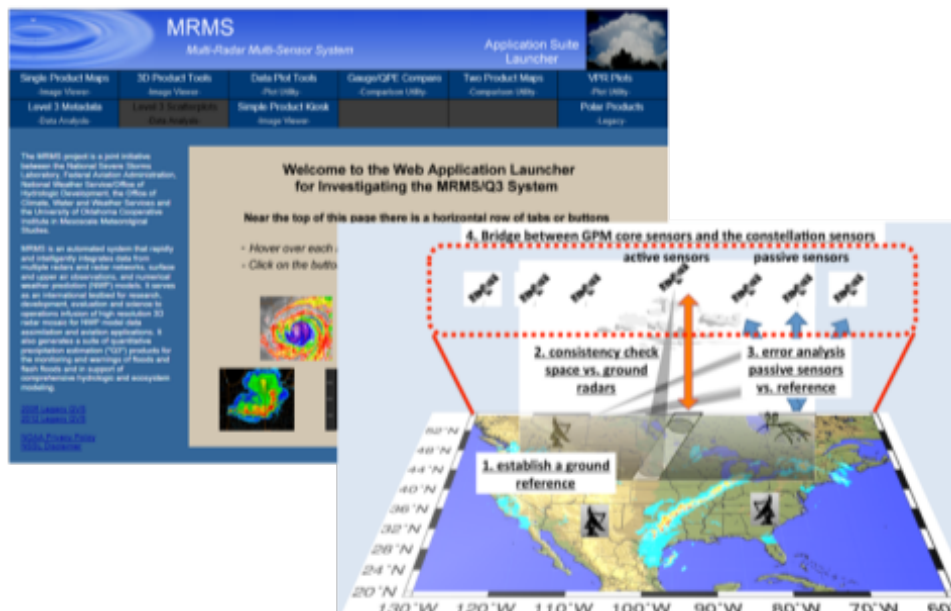
GPM Project Scientist
(Gail Skofronick-Jackson)

TRMM Project Scientist
(Scott Braun)

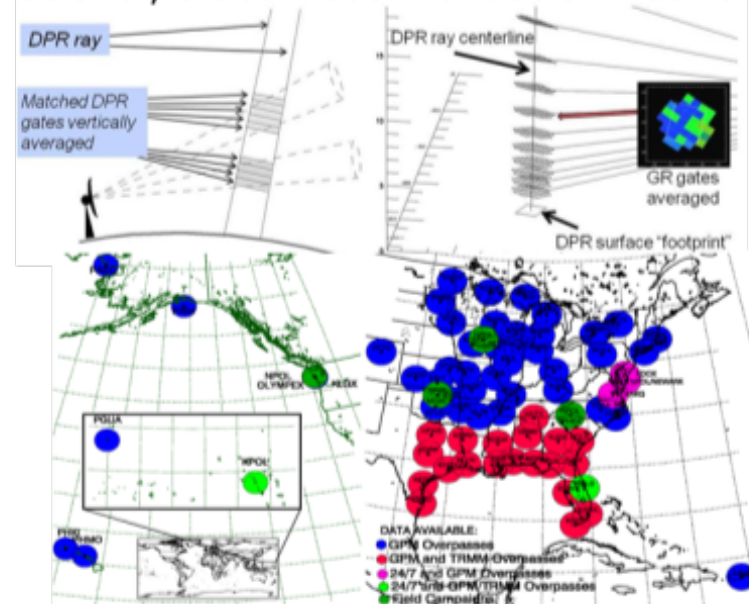
Science Team - 60 NASA funded PI's,
22 no-cost international PIs, **Algorithm Development** (Iguchi, Meneghini, Olson, Kummerow, Huffman), **Ground Validation** (Walt Petersen), **Intersatellite Calibration** (Wes Berg)

Application and Communications Team (Dalia Kirschbaum)

National Merged Radar and Gauge GV (MRMS)



National/Global Radar Validation Network



Regional Networks, Tier 1 Sites.....



Field Campaign Instruments and Data



Social Media (October 2016 Stats)

Twitter: [NASA_Rain](#)

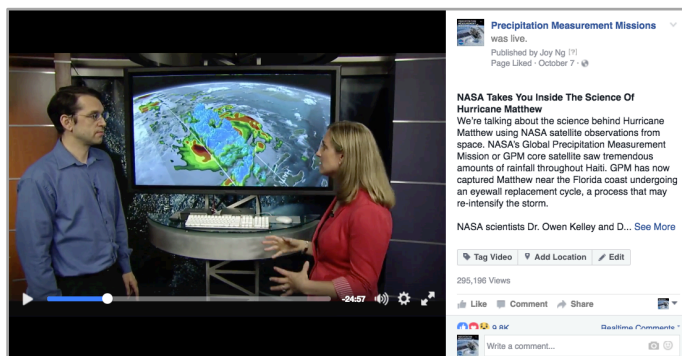
Total Twitter Followers: 17,513

Facebook: [NASA.Rain](#)

Total Facebook Followers: 49,202

Facebook Live Events:

10/7/16 Inside Hurricane Matthew



<https://www.facebook.com/NASA.Rain/videos/1214008668661911/>

Total Views: **295,195**, Peak Live Viewers: **8,660**

Likes: **7,746**, Comments: **3,285**, Shares: **2,326**

Send Us Content and Ideas!

We'll post for you!

<https://pmm.nasa.gov/contact>

PMM Science Team Meeting, Houston, TX October 24-27, 2016



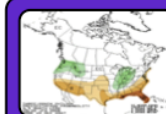
Extreme Events and Disasters

- Landslides
- Floods
- Tropical cyclones
- Re-insurance



Water Resources and Agriculture

- Famine Early Warning System
- Drought
- Water Resource management
- Agriculture



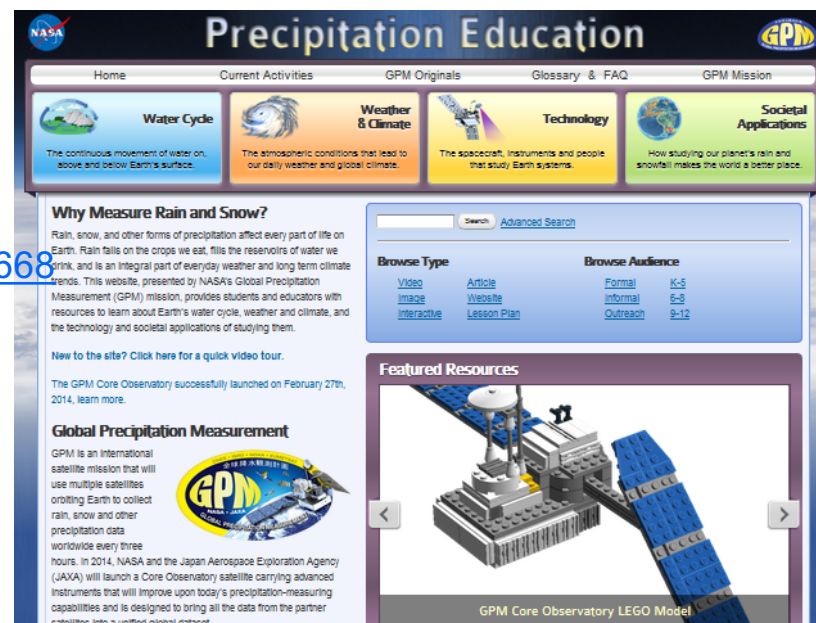
Weather, Climate & Land Surface Modeling

- Numerical Weather Prediction
- Land System Modeling
- Global Climate Modeling



Public Health and Ecology

- Disease tracking
- Animal migration
- Food Security



gpm.nasa.gov/education

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NASA PMM has **60** new PI teams (Selected Dec 2015 for 3-yr)

NASA has **22** no-cost International PI teams

New Principal Investigators:

- **Shuyi Chen**

Precip. Tracking & Water Cycle of the MJO

- **James Famiglietti**

Forcing in Hyper-Res. Land Surface Models

- **Robert Field**

Assim. Precip. into Global Fire Database

- **Min-Jeong Kim**

All-Sky Radiance Assimilation for GEOS-5

- **Dalia Kirschbaum**

Rainfall in Complex Terrain for Landslides

- **Pierre Kirstetter**

GPM retrievals and MRMS

- **Kwo-Sen Kuo**

Database of Single-Scattering Properties

- **Xiaowen Li**

Ice Collection Effic. w/Explicit Bin Microphys

- **Gerald Mace**

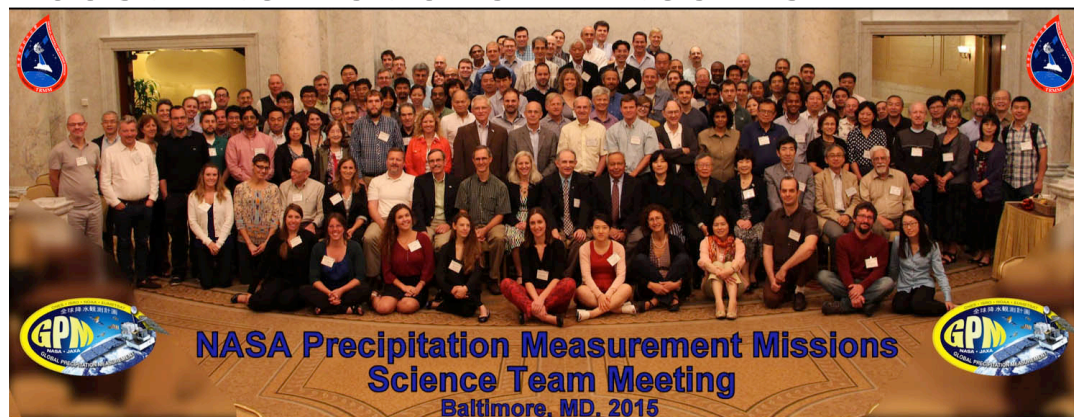
Ice Crystal Properties for Rtrvls in Stratiform

- **Stephen (Joe) Munchak**

Improved Active & Passive Surface Char.

- **Catherine Naud**

A Process Study of Extratropical Cyclones



- **Branislav Notaros**

Evaluation Framework of Bin & Bulk Microphys. in Winter Precip.

- **Brian Soden**

Statistical Downscaling of Precip. for Florida Water Management

- **Sun Wong**

Water-Budget Oriented Analyses

- **Norman Wood**

Precip. Microphysical Structure Aloft Using Cold Season GV

- **Huan Wu**

Global Flood Monitoring and Forecasting

- **Xiping Zeng**

Effects of Cloud Dynamics on Microphysics

- **Fuqing Zhang**

Improving Weather Prediction and Precipitation Estimation Through Advanced Ensemble Assimilation

Working Group	Lead	Meeting Time
Land Surface	Turk/Peters-Lidard	Monday 7-8:30pm
Latent Heating	Tao	Wednesday 6-9pm
Hydrology	Peters-Lidard	Tuesday 7:30-9pm
GV/OLYMPEX	Petersen	Tuesday 6-7:30
PSD	Williams	Monday 7-9pm
Applications	Kirschbaum	Tuesday Lunch
GPM Follow-on	Skofronick-Jackson	Tuesday 7-9pm
CEOS-VPC	Neeck	Friday 8am-3pm
Algorithm	Lead	Meeting Time
X-Cal	Berg	Thursday 8am-5pm
GPROF	Kummerow	Thursday 9am-2pm
Combined	Olson	Thursday 8am-9:30pm
Radar	Iguchi/Meneghini	Thursday 8am-5pm
Multi-Satellite	Huffman	Wednesday 7-9pm

End of Prime Review

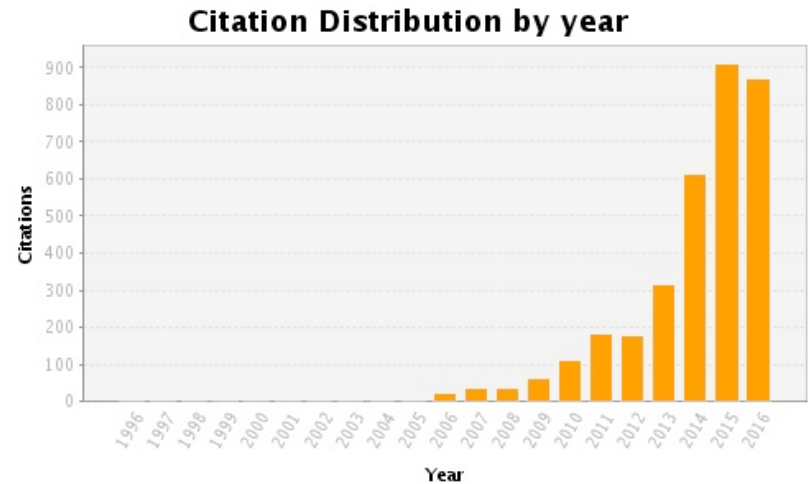
- GPM Prime Mission ends May 29, 2017
- **End-of-Prime review tentatively scheduled for June 15, 2017.**

Senior Review

- GPM Extended Mission begins with a funding bridge extension for the remainder of FY2017; confirmed in the End of Prime Mission Review in June.
- The NASA HQ Science Mission Directorate biennial Senior Review process, as implemented by the Earth Science Division, will be used for mission extensions FY18 and beyond:
 - This is a comparative review in which the primary evaluation factor is the scientific value of the dataset, with attention to the value of science that will be enabled by the extension of the dataset. Secondary evaluation factors include operational utility, technical health & status and cost efficiency.
 - Extension is assumed unless the mission is clearly underperforming.
- **Senior Review Dates**
 - March 3, 2017: Senior Review Proposal documents due
 - May 9-10, 2017 Presentation to panel (Science Panel Interviews)
 - June 30, 2017 Final Report

How can you help with these reviews?

- **Report** your GPM publications
 - Email publication references to Lisa
 - From 2006 to present:
 - more than 250 reported already
 - Total citations exceeds 3,300

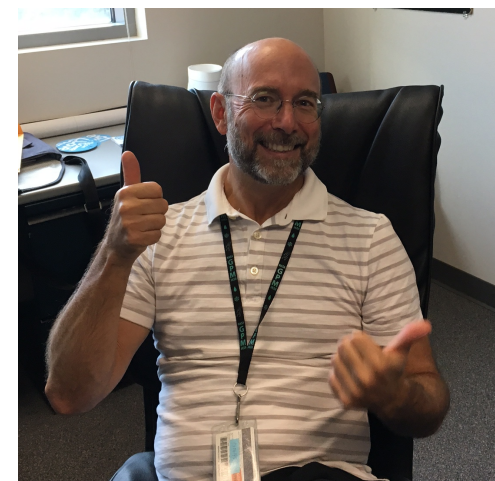


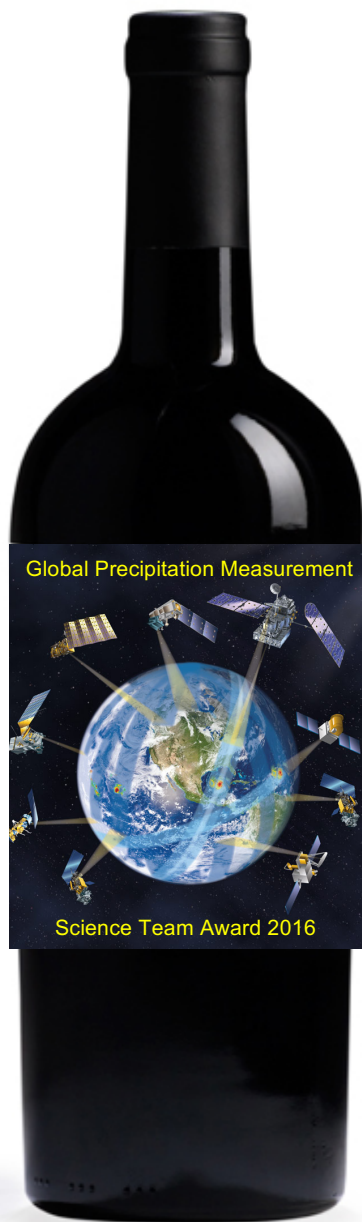
- Tell us of any **significant** uses of the GPM datasets for
 - Scientific achievements
 - Operational utility
- Help to **validate** the requirements (GV, Algorithms)
- **Suggest** scientific, algorithm, and/or operational **opportunities enabled** by an extension of the GPM dataset for fiscal years 2018 & 2019
 - **What important science should we do 2017-2019????**

- The AMS special collection on GPM is expected to include papers on
 - cross-calibration between satellite sensors,
 - precipitation algorithm development and evaluation,
 - scientific studies and modeling related to precipitation,
 - ground validation analysis, and
 - application-related investigations for societal benefit.
- Articles can be submitted to:
 - Bulletin of the American Meteorological Society,
 - Monthly Weather Review,
 - Journal of the Atmospheric Sciences,
 - Journal of Applied Meteorology and Climatology,
 - Journal of Atmospheric and Oceanic Technology,
 - Journal of Hydrometeorology, and
 - Weather and Forecasting
- Prior articles can be included (let me know if you've recently submitted)
 - Includes GPM Post-Launch Status paper & Applications paper
- For future articles, during submission there should be a dropdown box with all the special collections listed. **Due July 2017.**

There is already a special collection:
Precipitation
Retrieval
Algorithms for
GPM (in JAOT)

- Tom Wilheit has officially retired (again)
- Mathew Schwaller plans to retire spring 2017 (for the first time)
- Ed Zipser received the AMS Rossby Award
- Chandra was Knighted by Finland (insignia of Knight, First Class, of the Order of the White Rose of Finland)
- Send us your news!





*Arthur's tradition: Award
WG/team that improves
algorithm performance using
actual data*

*Gail's Update: Award
Person(s) or Team(s) that
significantly enhance PMM
science*

Citation: For exceptional dedication to ensure a successful NASA GPM OLYMPEX field campaign.



**The OLYMPEX
Field Campaign
Team (presented
to Lynn McMurdie)**

Citation: For initiative in seeing the need and usefulness of comparisons of observations from two missions, creating coincident data, and making it freely available to the community.



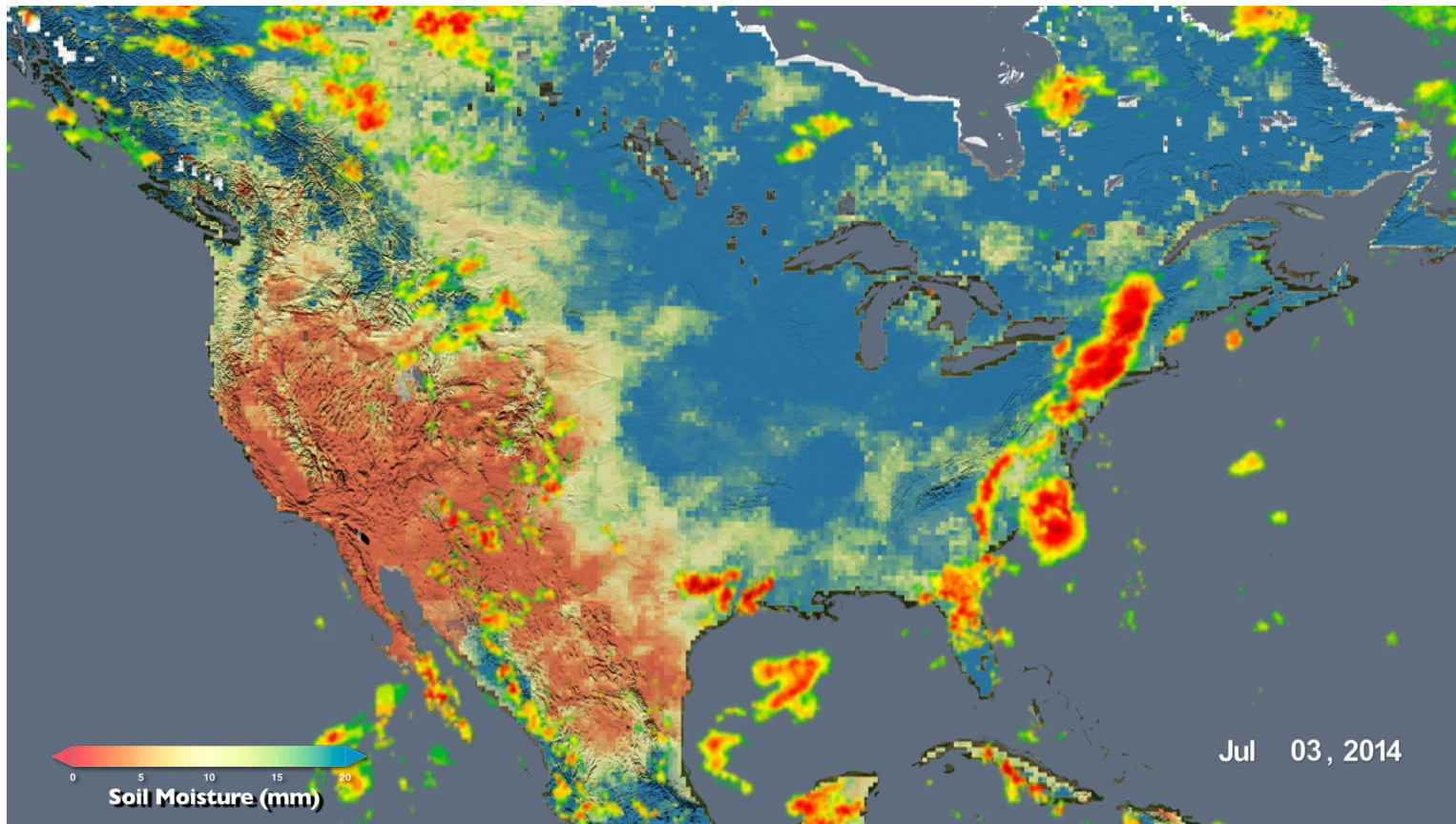
Joe Turk

Contact Information: Gail.S.Jackson@nasa.gov

GPM Info: gpm.nasa.gov Data: pps.gsfc.nasa.gov

Social Media: *Twitter*: NASA_Rain *Facebook*: NASA.Rain

Teacher Page: pmm.nasa.gov/education Movies: svs.gsfc.nasa.gov



IMERG Rain and Soil Moisture movie

GPM Zonal Mean Annual Accumulations Calendar Year 2015

